

# FUKUTANI LAB.

## [Surface and Interface Science]

Department of Fundamental Engineering

Surface and Interface Physics

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### Dynamics of Electrons, Spins, and Protons at Surfaces

#### ■ Overview

Surfaces and interfaces have different electronic states from those of bulk materials, because they have lower dimension and symmetry compared to the bulk. Thus, the surfaces and interfaces are expected to reveal particular properties, such as interface electric conductivity and catalytic activities. Particularly, surfaces play an important role in the formation, storage, and sensing of hydrogen that is a clean energy medium. In our laboratory, we develop novel experimental techniques to precisely observe hydrogen in aimed at elucidating the mechanisms of proton transport, electron dynamics, spin conversion and molecule formation at surfaces, which leads to synthesis of novel functional surfaces.

#### ■ Experimental techniques

[Hydrogen microscope]

Nanoscale measurement of 3D H distribution under atmospheric pressure

[REMPI]

Precise measurement of atoms and molecules

[2-photon ARPES]

Measurement of photoexcited states

[Spin-polarized hydrogen]

Spin dynamics / surface magnetism

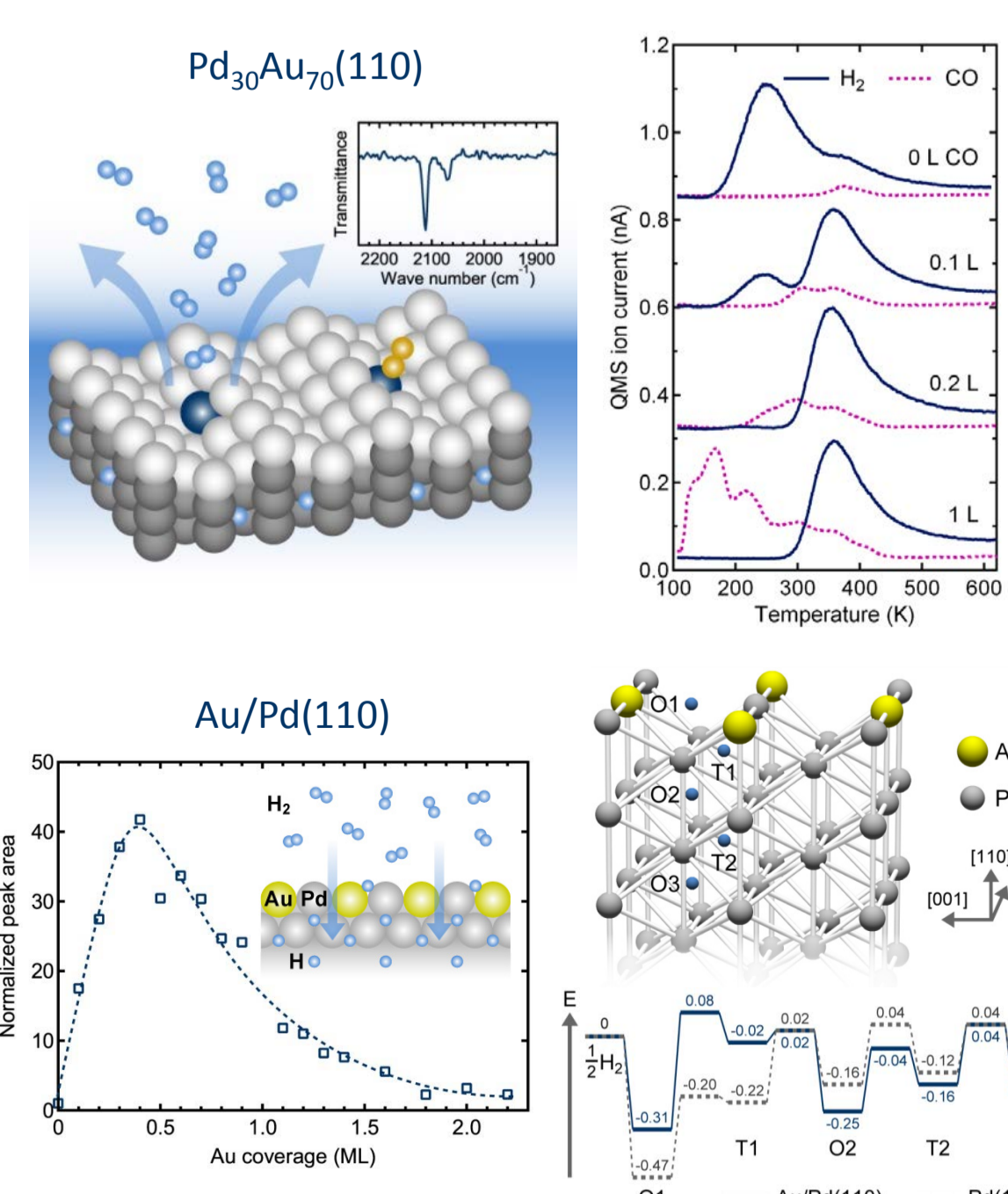
[STM, TDS, RAIRS]

Surface structure / adsorption states

#### ■ Recent results

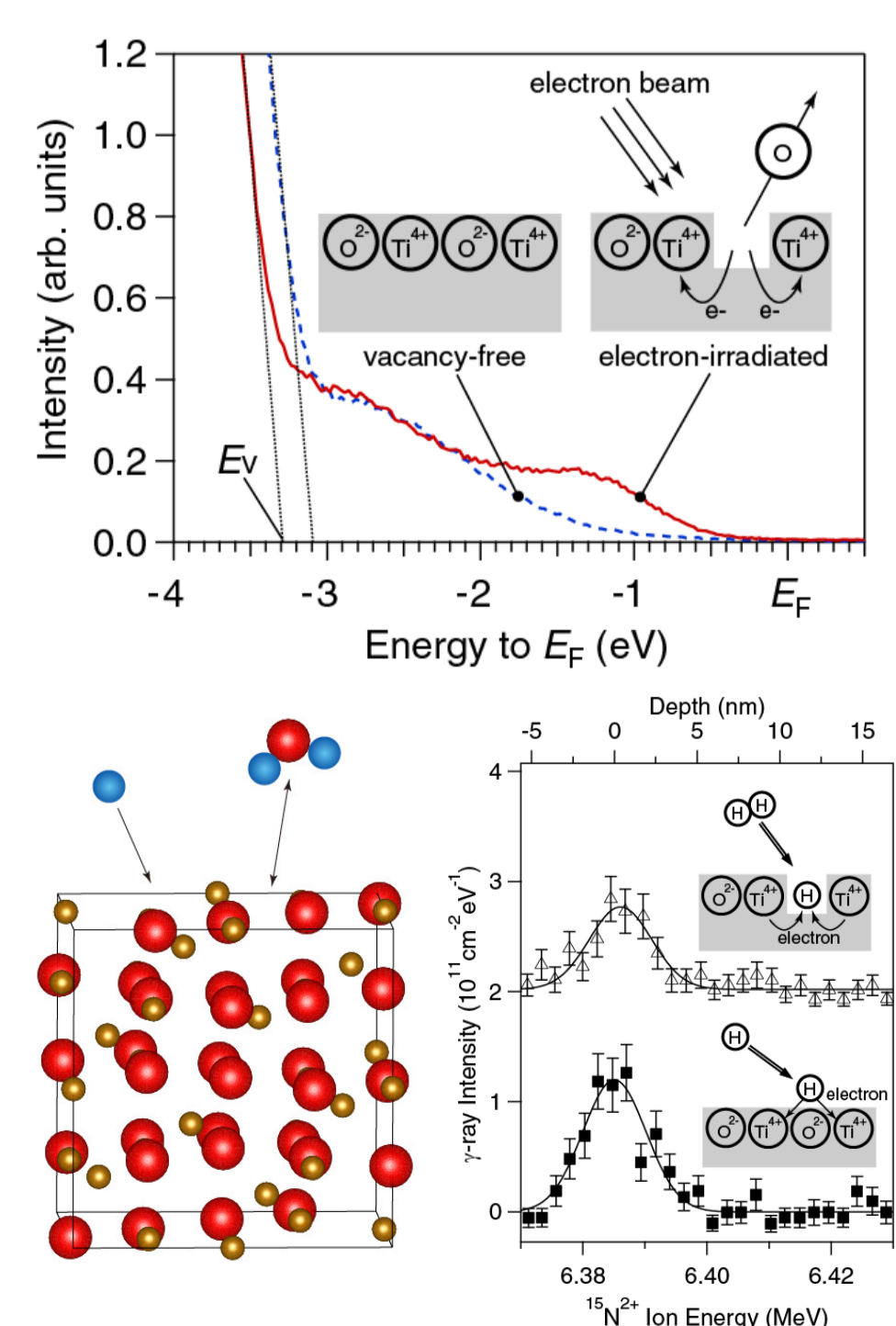
[Control of H ab/desorption]

- Molecular cap
- Reaction with adsorbed H
- Superconductivity by H



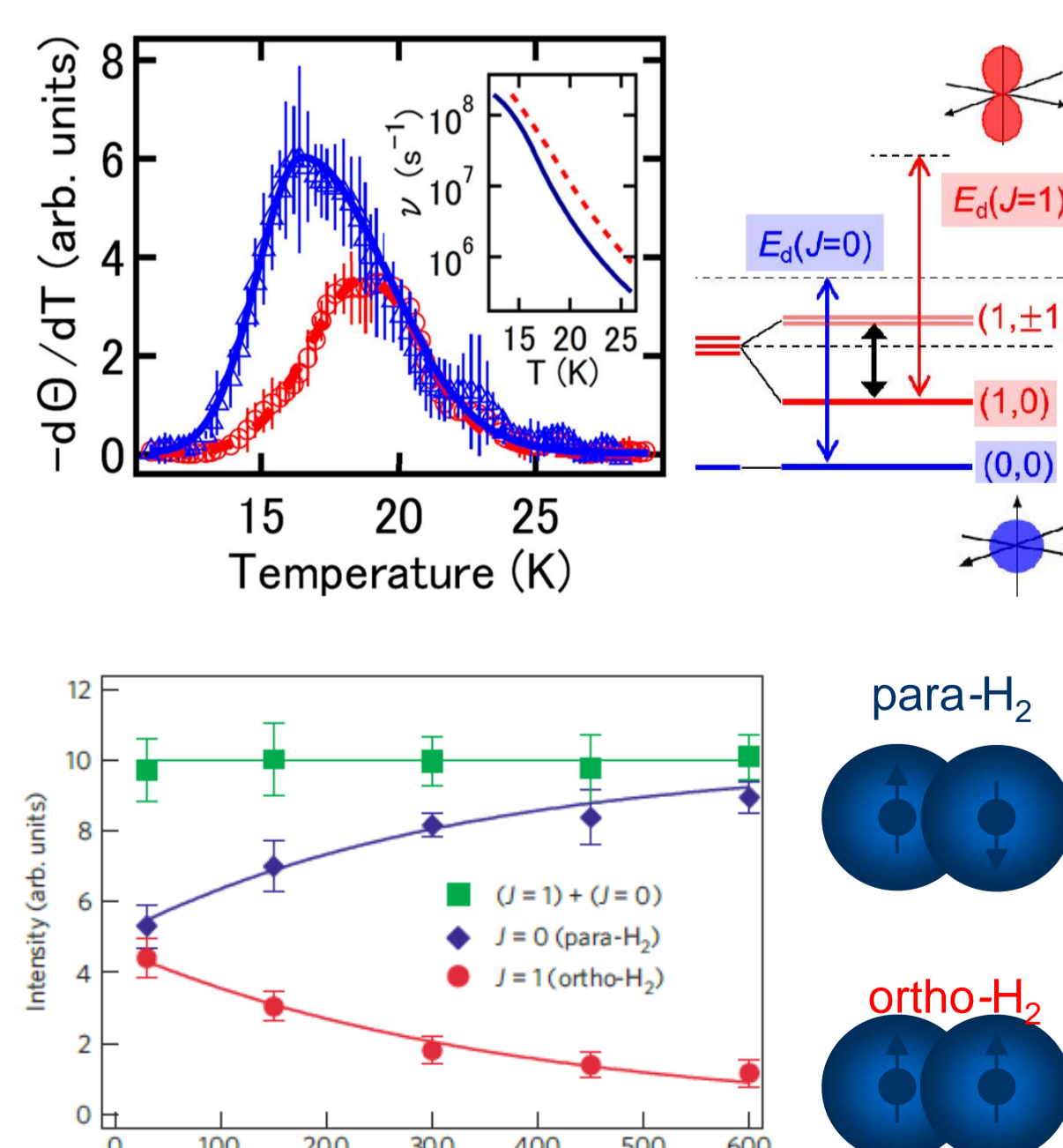
[Electronic control of metal oxides]

- Metal-insulator transition of SrTiO<sub>3</sub>
- H-induced surface states of TiO<sub>2</sub>



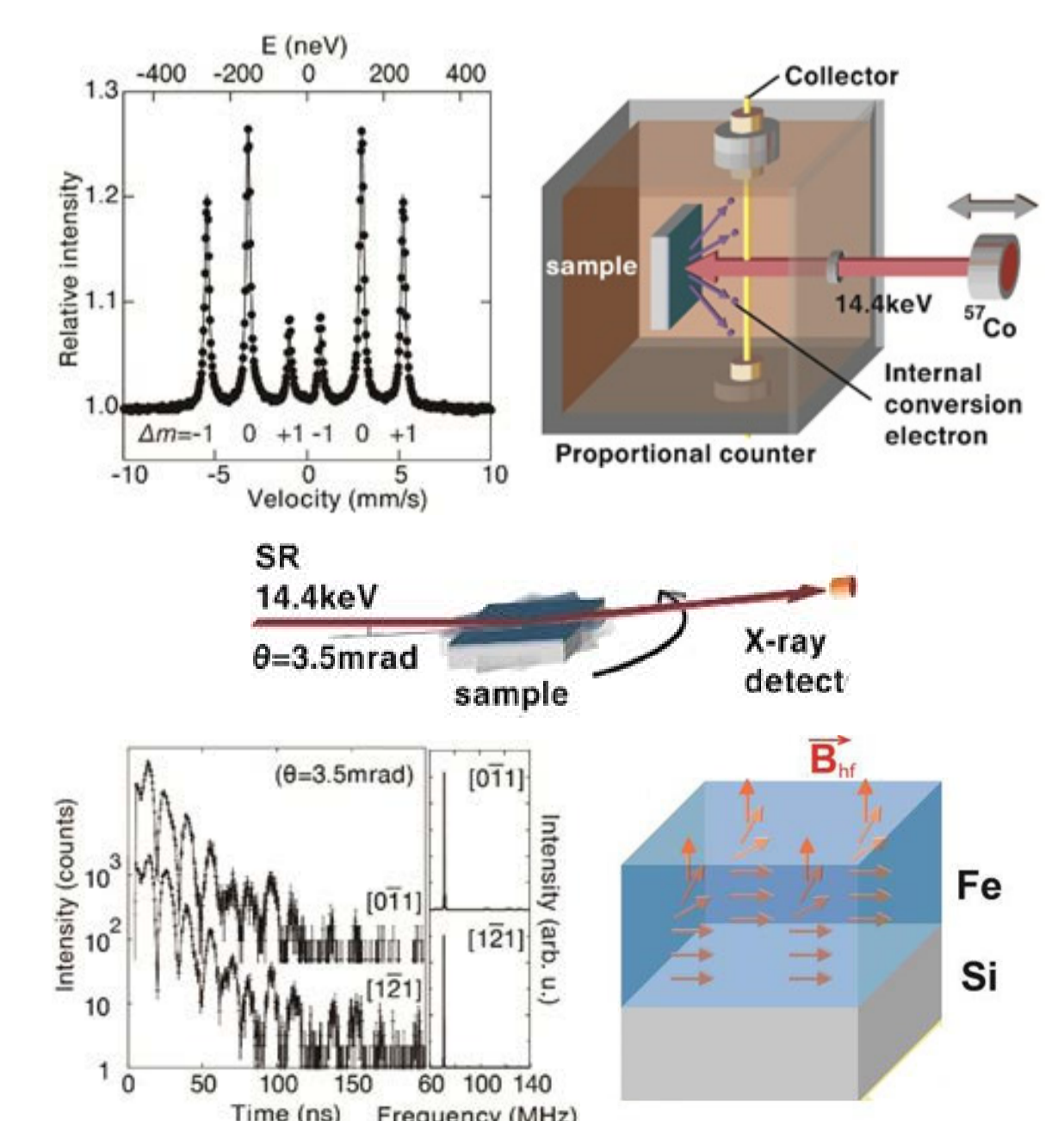
[o-p conversion/separation]

- Spin conversion by electric fields
- Hindered quantum rotation
- Spin separation by scattering

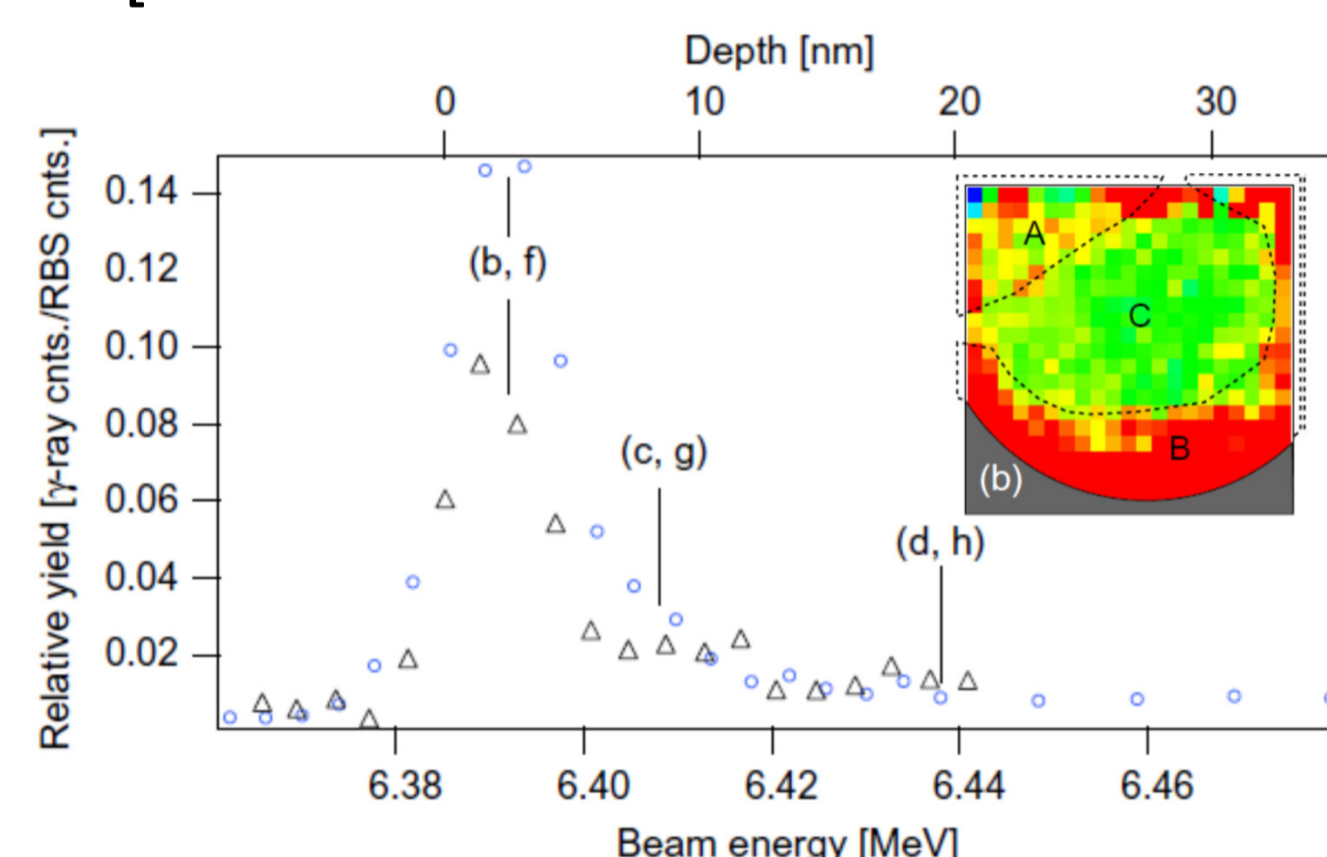


[Interface magnetism]

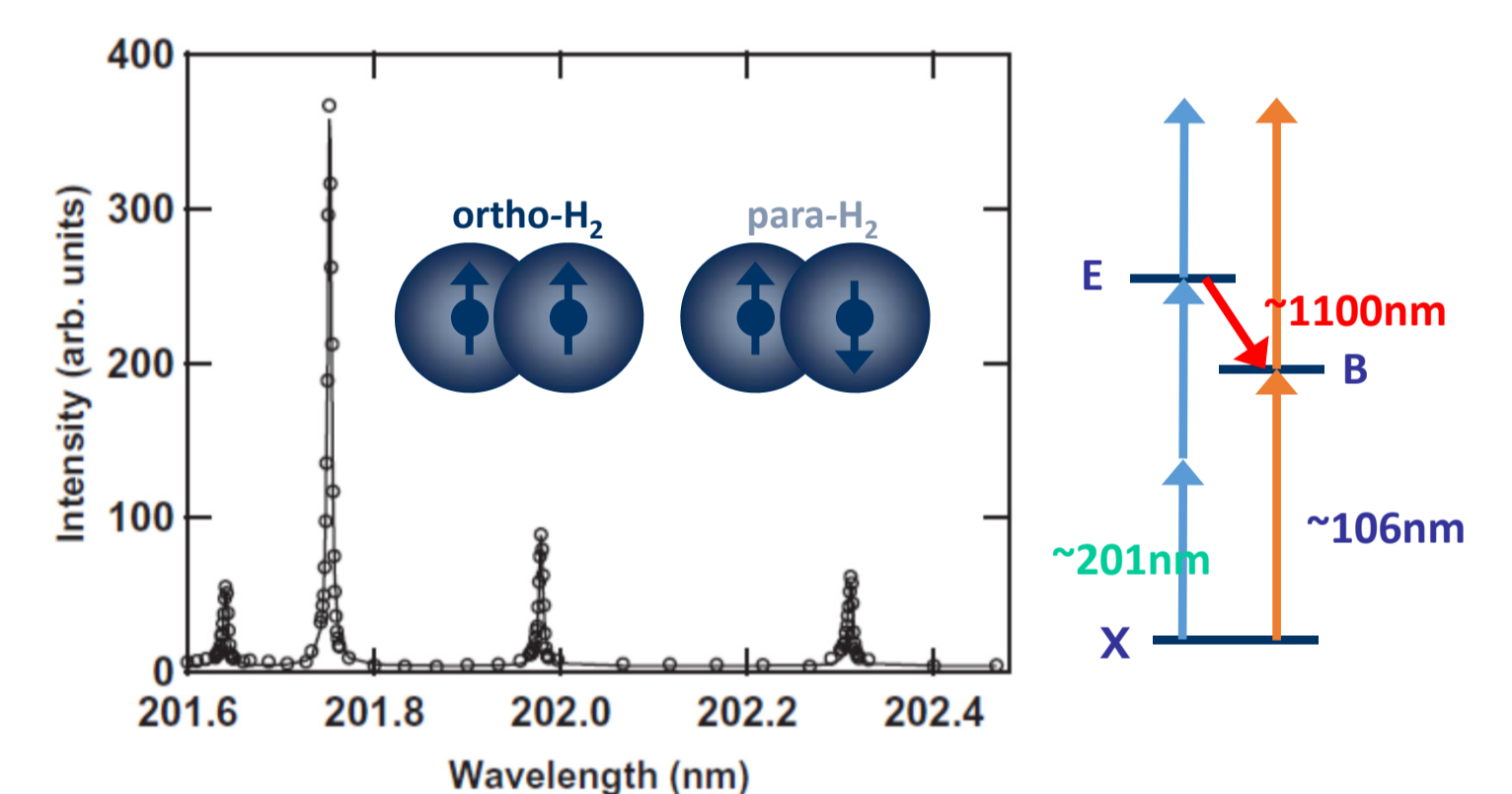
- Magnetic canting of Fe thin films
- Magnetic structure of Fe<sub>3</sub>O<sub>4</sub>



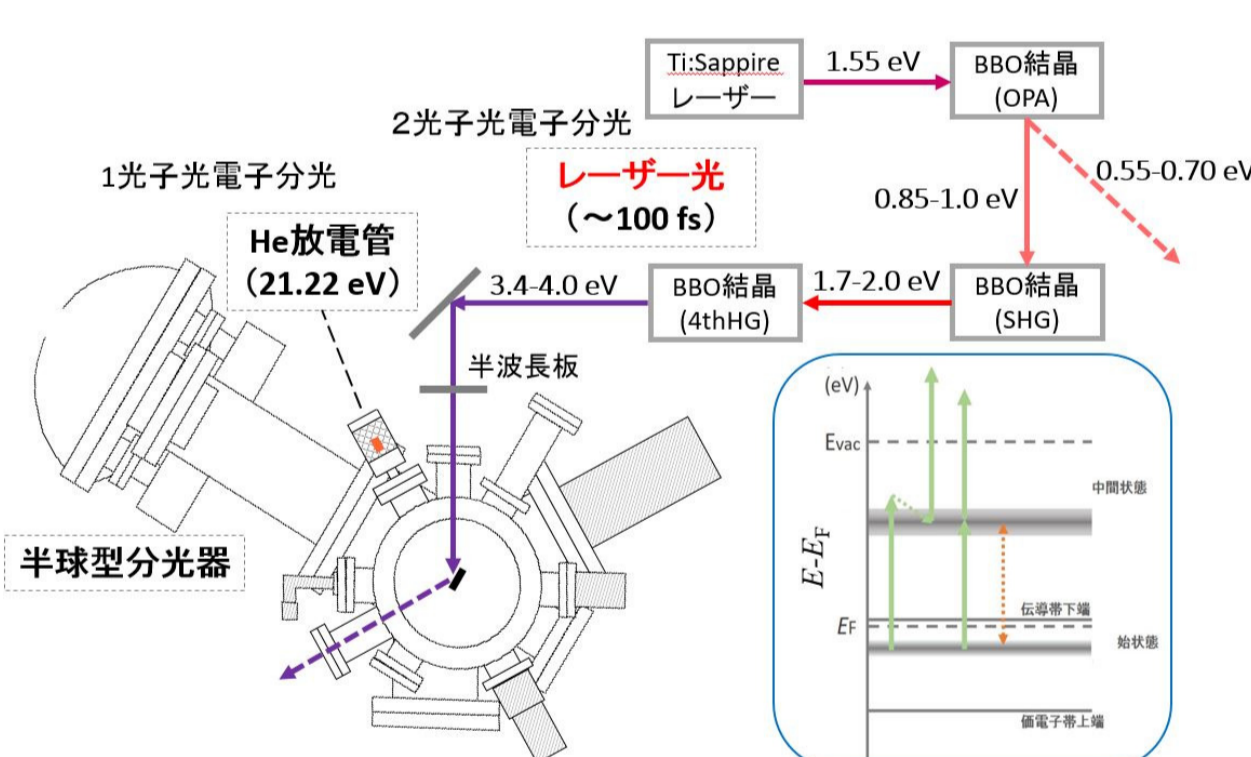
[H distribution of fractured surface]



[Rotational spectroscopy of H<sub>2</sub>]



[Measurement of photoexcited states]



[Spin-polarized hydrogen]

